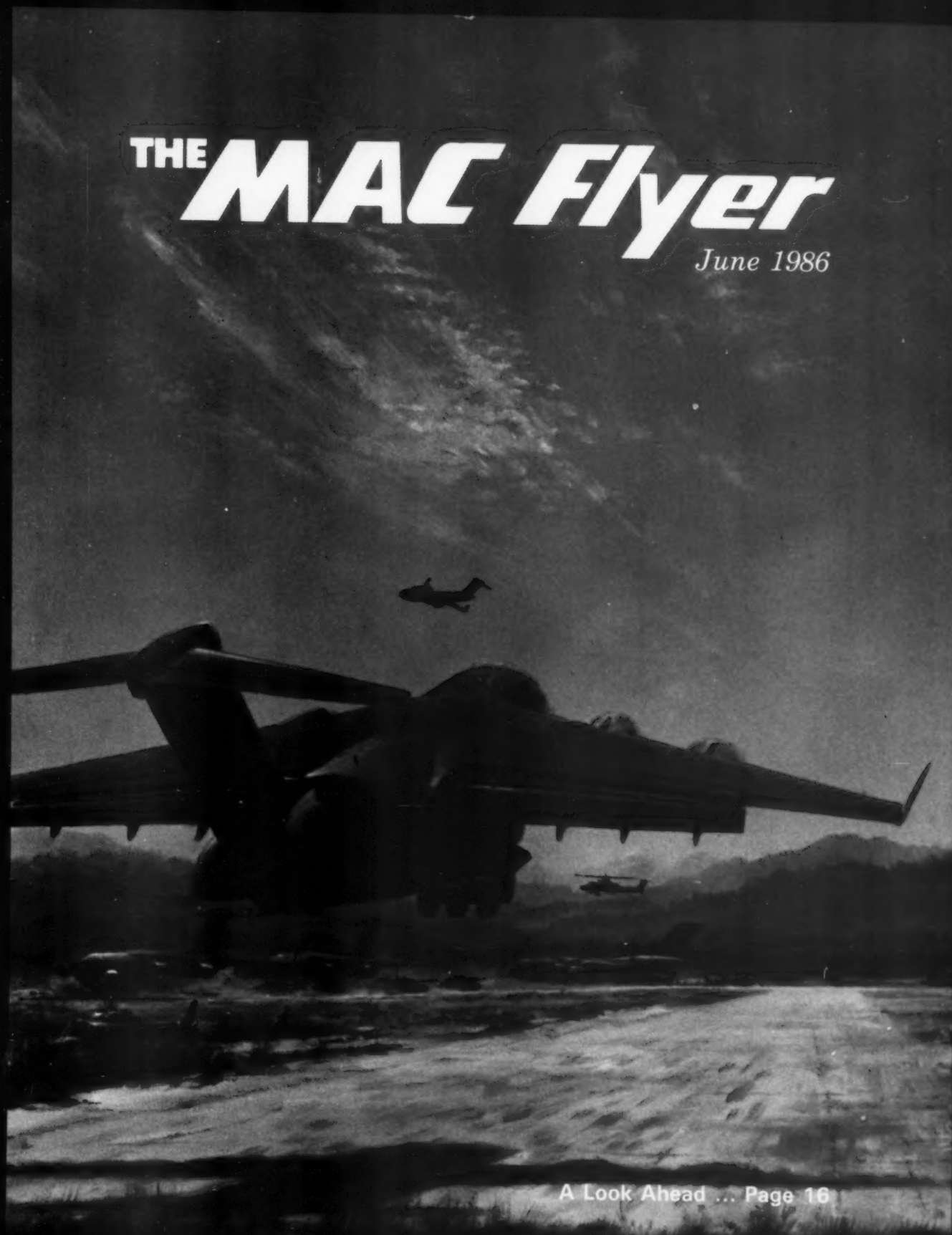

THE MAC Flyer

June 1986

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THE MAC Flyer

For Greater Safety in MAC Air Operations

June 1986 | MACRP 127-5 | VOL XXXIII NO. 6

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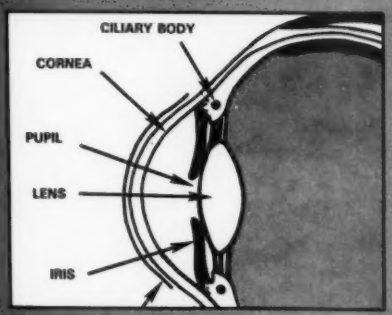

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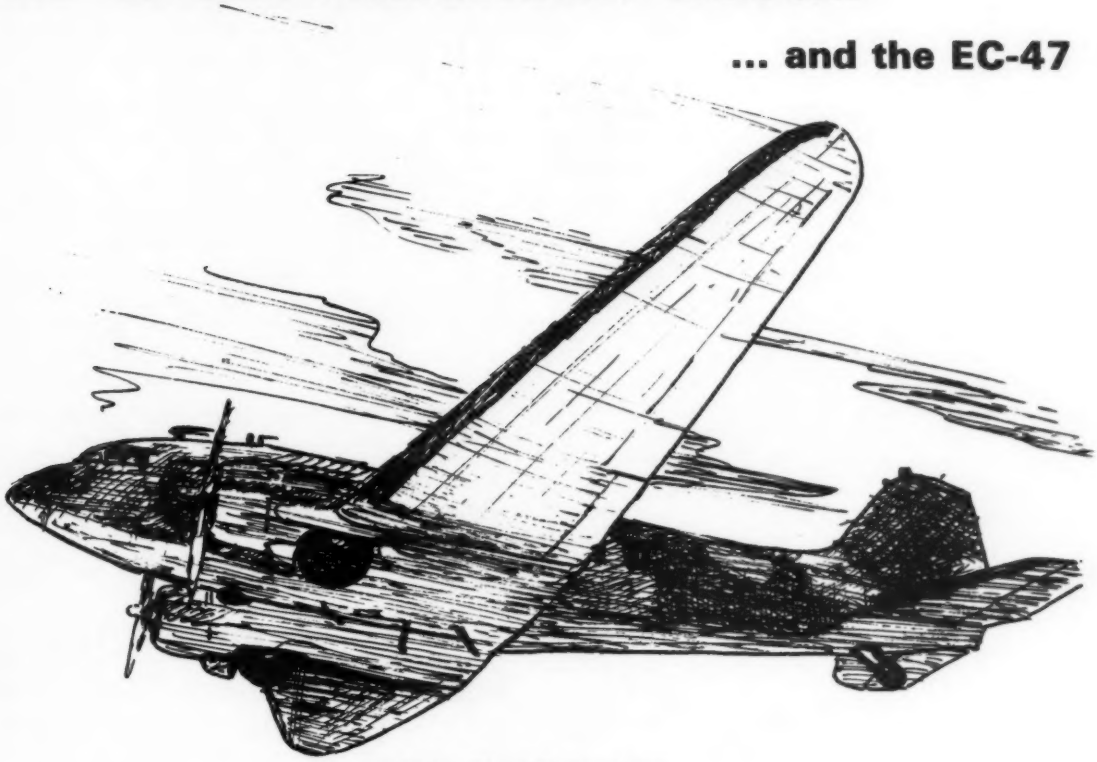
The Great American Recall

... and the EC-47



by Major Girard Hoffpauir, III

In February 1970, I graduated from Undergraduate Pilot Training. My first assignment was as a pilot in the EC-47 in Vietnam. My first question was, "What is an EC-47?" Then I asked, "What is its mission?" Within a week, I had an idea about the aircraft but not about its mission. After a three-week trip to Fairchild Air Force Base, for what was termed "survival school," I arrived at the EC-47 training location, England Air Force Base, Louisiana. On the second day, I met my instructor and got my first look at the C-47 Skytrain. As you might guess, I was not impressed with this airframe built years before I was born. I was even less impressed when I discovered the simulator was of a B-26—Yes, I said B-26! They didn't even have a Link simulator of the C-47. After a few weeks, though, I had learned to respect this "Grand Ol' Lady" of the skies, and knew what she could do to you if you tried to take her for granted. This 'Lady could be very forgiving but could also reach back and "Bite you right where you sit" if you mistreated her. (I was fortunate that, in over 1,000 hours of flying this 'Lady, I never found myself on her cross side.) After four weeks of training, I graduated as a qualified, but not combat-ready, copilot. Experience would come "in country," so I was on my way to Vietnam.

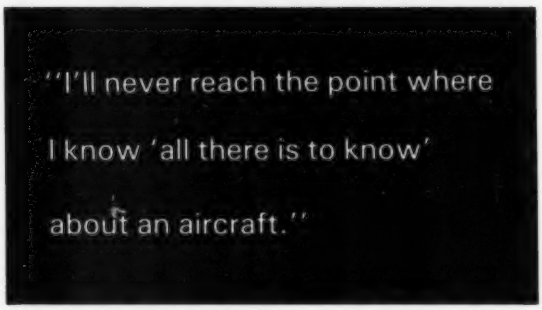
After a stop in the Philippines for jungle survival school, I was inbound to Vietnam and Tan Son Nhut Air Base, near Saigon, to fly the still-mysterious EC-47 Gooneybird. Shortly after my arrival, I was given a ride to the squadron operations area to meet the members of my new unit, the 360th Tactical

Honorable Mention 1985 Flight Safety Writing Contest

Electronic Warfare Squadron (TEWS), better known as the "OLD TIGERS." On this day I became a member of the "Antique Airline" and another "Old Tiger" to carry on the tradition.

My introduction to the mission was not the only new experience I encountered that day. I was also introduced to what I like to refer to as the "Great American Recall"—of pilots, that is, not cars. This is what I found it to be! In the early '70s, the Air Force was suffering a pilot shortage. It seems that the Air Force was losing many pilots to the airline industry. So, in order to meet the requirements of the Air Force, especially during the Vietnam conflict, the leadership searched for pilots that had once flown some of the mission aircraft and "convinced" them they should return to the cockpit, even after years of flying a desk. Most of these senior officers had been out of the cockpit for an average of eight years, and some for as long as 15 years. You can just imagine what level of proficiency they brought to the cockpit. These were the pilots I was routinely scheduled to fly with, or as I would rather think of it . . . "babysit."

What problems could such pilots create? First of all, the airplane was easy to fly, except during two critical phases of flight, takeoff and landing. If you are unfamiliar with the aircraft you might ask why these two phases are more critical than any other? The Gooneybird is a "tail-dragger," an airplane with a tailwheel. If you aren't extremely careful, *that tailwheel* can really eat your lunch, in a matter of a few seconds. So, if an individual, whose natural reflexes are a little bit rusty, steps in and takes the controls of this aircraft and attempts to fly it, you might soon have an accident (mishap these days), or at least, an unsafe condition. Don't misunderstand me! Not all of these pilots were dangerous, but there were always a few that required close observation. Most pilots would quickly gain some of that long lost proficiency back. The few who didn't would assume staff jobs so they wouldn't have to fly as much. Instead, they would hide behind a desk and fly fewer and fewer missions. This meant that when they *did* fly, the copilot would be forced to watch them closely, thus placing himself in a more stressful situation. The copilot would then act as both pilot and copilot. He had to perform both duties and would seldom leave the cockpit during the five- to seven-hour missions. Initially, the added stress would not be any problem, but would soon realize that it would become more and more difficult to psych ourselves in order to be totally aware during the takeoff and landing phase of each mission. The degree of difficulty was compounded by the time of day and the activity on the mission. It is very tough to get "up" for a landing after a seven-hour mission that is terminating just prior to sunrise. How would you handle yourself in a similar situation? But wait! I haven't yet mentioned the added pressure placed on the young pilots by the other crewmembers. These nonpilot crewmembers, aware of the



short-comings of the nonproficient senior pilots, expressed their concerns to the young pilots/copilots. They would expect the younger pilots to make sure the landing was uneventful.

Who were these "daring young pilots" selected to fly with those senior pilots? If it hasn't occurred to you by now, I was one of a small group of pilots selected for the task. I had been classified as a strong copilot, which led to my selection. We would rotate so we wouldn't fly two missions in a row with the same individual. What did we do to release some of the stress placed on us by the added responsibility? Well, I would try to relax before and after each mission. This included listening to and taping soft music. On many occasions, I met with the other young pilots and compared notes, thus improving our knowledge of any developing bad habits on the part of the senior pilots. Such an exchange of information reduced the possibility of sudden surprises. It was similar to a group of instructors discussing their students. Looking back on those times now, I realize we *were* acting as instructors, only without

the official designation. We thought that when we would upgrade to aircraft commander, we would be relieved of the task. We couldn't have been more wrong! We were told that since we were doing such a good job, we would continue as copilots to the senior pilots until they rotated back to the States and their old desk jobs. By the end of my tour in Vietnam, the Air Force had managed to relieve the shortage by drawing on the younger pilots flying for the Strategic Air Command and the Military Airlift Command and replacing them with pilots returning from Vietnam. This also upgraded the proficiency of the average pilot in the unit.

How did that experience effect the future of these young pilots? That's a simple question, though the answer is quite complex. I can only speak for what impact it had on my flying career. It enhanced it a great deal. My first thought after getting my assignment was that I would step back in aviation history instead of moving forward, since the aircraft I flew in Vietnam was built before I was born. What I wasn't prepared for was all the great moments flying the Gooneybird. There are only a few of us left that can relate to that experience. It was one of the easiest airplanes to fly most of the time, except for the takeoff and landing. I have never lost my respect for the airplane and developed an attitude that I would always carry with me. That attitude was, "I'll never know all there is to know about the flying machine." I learned from each experience and have been able to apply that knowledge throughout my career. I developed a burning desire to know every aspect of the mission. When I flew the KC-135, the mission was fairly simple, but there was still a challenge. In a career enhancement move, I, too, was selected to fly a desk. So for the first time in my career I had to deal with something else. After three long years, I returned to the cockpit in the new E-3A, Airborne Warning and Control System (AWACS). After being a part of the system for two and a half years, I had already applied all my efforts to learn all aspects of the mission, so flying the "front end" came easy. I was one of the very few who not only knew how to fly the airplane, but had a working knowledge of the mission. Such knowledge enhances mission accomplishment.

In my present flying assignment with Special Air Missions (SAM), I'm still striving to learn every aspect of the mission. I think I will always have that desire and will always strive to learn more about my aircraft.

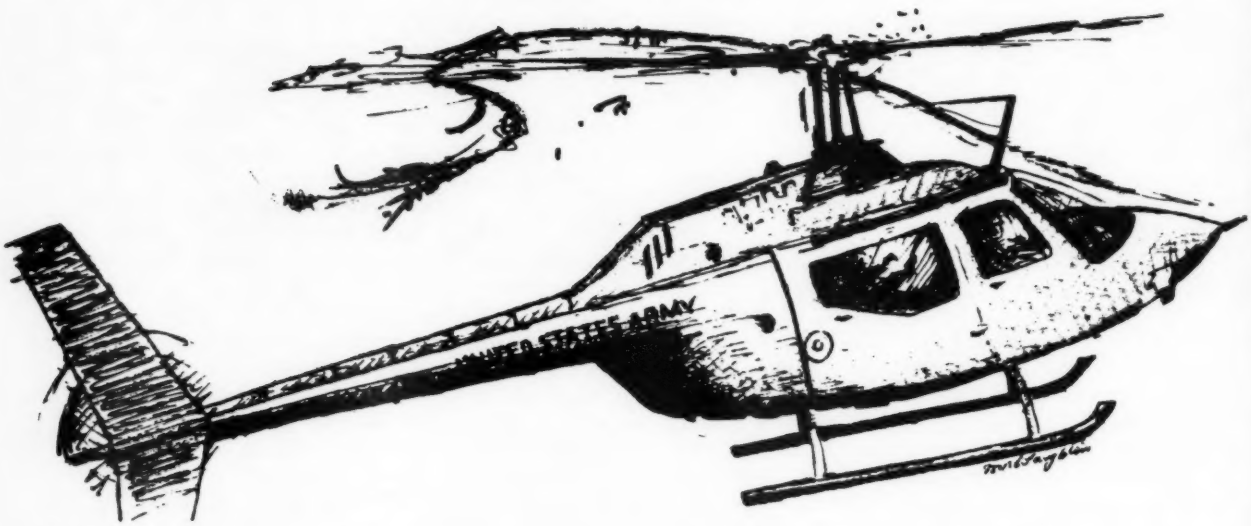
As a flight safety officer, I have the opportunity to fly on all the wing aircraft. These aircraft are C-137Bs, C-135Bs, C-140s, C-9Cs, C-20As, C-12A/Ds, UH-1Ns, and CH-3Es. I guess that I could just sit back and watch the mission unfold, but not me. I have to ask questions and be involved in the activities. I want to know more about the aircraft and the crew. I want to improve my knowledge and abilities.

Thanks to the "Great American Recall" of the early '70s, I was placed in a high pressure learning environment, with a need to know every aspect of the mission so that I could fully function on the aircraft and provide my best toward the mission. The key words of the SAM crewmember are Safety, Service, and Reliability. Safety is never compromised for the other two. Knowledge of the aircraft is the key to a safe operation. However, I will never reach the point where I will think that I know all there is to know about an aircraft. The day that happens I will quit, because that may be the day I would take that *stupid chance*. I refuse to ever become "AN ACCIDENT WAITING FOR A PLACE TO HAPPEN."

Major Hoffpauir completed UPT at Webb AFB, Texas, in 1970. His assignments have included EC-47s, KC-135As, E-3As, and C-135Bs and spanned four major commands; PACAF, SAC, TAC, and MAC. He is currently assigned to the 89th MAW as the Chief of Flight Safety and flies as aircraft commander in the C-135B in support of the wing's Special Air Missions (SAM).

The Invisible Wire

Unseen and Deadly.



The pilot was feeling a sense of pride mixed with just a hint of apprehension as he guided the OH-58A on short final approach for landing at a football stadium. Pride was the natural product of the confidence he had in his flying ability coupled with the opportunity to demonstrate this ability to the crowd gathered in the stands. His apprehension was the direct result of the utility poles he discovered along the sides of the field. His tactical training and prior experience around built up areas had taught him to suspect wires any time poles were sighted, but then, he had taken every precaution required by "the book," plus he had cautioned the other people aboard the aircraft to watch for wires. He also held a slower than normal airspeed on short final to make a go-around easier, should anyone detect a wire.

The winter mission in support of the district recruiting command had been a good one. This was the last stop on the third and final day of aircraft static displays at various local schools. The local recruiter, a passenger in the rear seat, had coordinated the times of the visit and the proposed landing sites with the appropriate school officials. Both he and the crew chief, who was in the left front seat, helped the pilot identify hazards during the aerial reconnaissance of landing areas. The students were genuinely interested, both in the presented information and the aircraft, and recruiters seemed well pleased with the results of the mission.

Flying about 50 feet above the ground on final approach, the pilot verified his touchdown point and was approaching loss of effective translational lift when his peripheral vision detected a wire cable as it passed just above the windscreen. The aircraft immediately shuddered and pitched slightly nose-up. At this point all cyclic and collective control was lost and an explosive noise was heard from the rear of the aircraft as it neared the ground in a level attitude. The pilot could detect no response from collective application.

During the jarring impact with the ground, the pilot felt the right side of his seat collapse and saw the left cockpit door leave the aircraft. The crew chief didn't seem to be hurt but the passenger in the rear seat appeared to collapse when he tried to stand up as he stepped from the aircraft. The pilot yelled at him to stay down because

the rotor blades were lower than normal due to the collapsed skids. The pilot couldn't tip the rotor system away from the passenger because of the lack of cyclic control. By the time he finished shutting down the aircraft, the local rescue unit and fire truck were arriving on the scene.

After a doctor examined everyone on board the aircraft, the pilot and crew chief were released and returned to the crash site. The passenger was admitted to the hospital with a severely strained back.

The cable the aircraft hit severed the #2 FM antenna before destroying the pitch link connector assemblies above the swashplate. This explained the loss of both cyclic and collective control. The explosive noise was, apparently, the main rotor blade severing the tail boom when the main transmission isolation mount and drag pin assembly were destroyed, allowing the transmission and rotor system to tilt aft. Both crew seatpans were deformed and major structural damage was visible throughout the airframe.

As he stood examining the broken ends of the multi-strand, galvanized steel wire cable which destroyed the aircraft, the pilot mentally reviewed the sequence of events attempting to understand why he had failed to see the cable. Although the midday, high, gray overcast condition reduced the normal ambient light, the visibility was practically unlimited as he approached the town at cruise altitude. The passenger pointed out the stadium location and the pilot started his reconnaissance as they passed over it. Passing the field, he started his letdown as he told the crew chief and the passenger to be especially alert for wires and obstacles as they were about to enter a high-hazard environment in the stadium area.

Passing (at 500 feet) along the west side of the stadium, the pilot noticed the banks of floodlights on utility poles along both the east and the west sides of the playing field, which made it appear narrower than the other stadiums they had visited which had no lighting. He also located two sets of power lines off the north end of the field which he would have to stay above when he started his final approach to the south into the stadium.

Turning left, around the south end of the field, the pilot dropped to 300 feet AGL to prepare for his downwind leg along the east (opposite) side of the stadium away from the school buildings and playgrounds. This gave him a good view of the long axis of the stadium and, although there were numerous wires between the utility poles along either side of the stadium, no wires were visible crossing the stadium. The reconnaissance continued on an extended downwind and base leg. Turning final, the pilot slowed his airspeed more than normal to give additional time to look over the area. He again reminded the crew chief and passenger to "keep your heads up."

Airspeed was just above effective translational lift and the helicopter just cleared the goalpost at the approach end at about 50 feet AGL when the pilot saw the cable pass above the aircraft windscreen. From where had it come? How could three sets of eyes on three separate passes over and along the field and during a slower than normal final approach into a recognized high-hazard environment, fail to detect a multistrand cable directly across the flight path?

Environmental factors probably contributed substantially to the pilot's inability to see the cable. Reduced ambient light due to cloud conditions, coupled with the gray color of the galvanized cable, caused it to blend with the bare hardwood trees, dead grass, and paint-faded buildings in the background as the pilot conducted his aerial reconnaissance. The single course of action with the highest probability of success in preventing similar mishaps would be a physical ground reconnaissance of helicopter landing areas located in or adjacent to hazardous environments, e.g., in or near built-up areas.

School and city officials were not aware of the cable and were unable to provide a logical explanation for its presence as it appeared to serve no useful purpose at that location and height.

(Editor's note— Even though MACR 55-54 requires a separate low reconnaissance pattern unless OGE power is available, and recommends site evaluations be flown using the same flight path intended during actual final, we aren't immune to wire strikes. For further comments on the problems with wire identification, see "The Limits of Sight," this issue.)

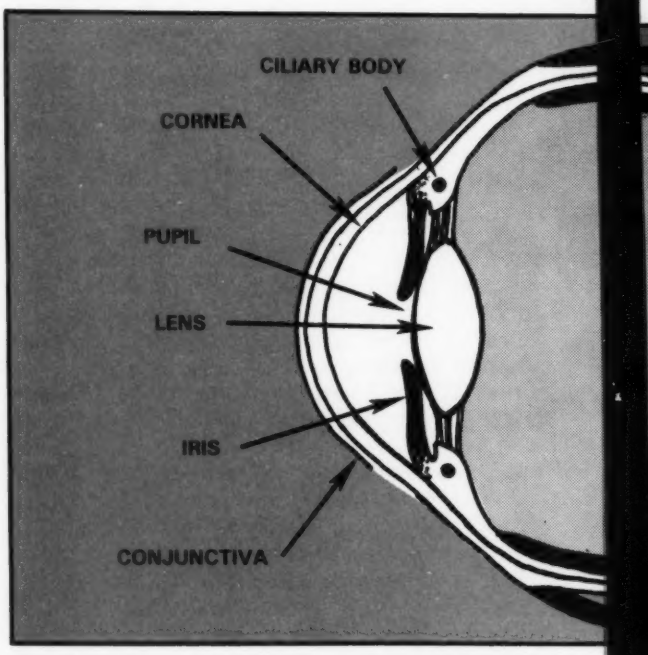
Courtesy *FlightFax*

The Limits of Sight

You can't always see what you look at.

The human ocular system is nothing short of phenomenal. Our eyes are so good, in fact, we must learn not to rely on them absolutely. This is even more important for the aviator, as his environment changes at nearly the speed of reaction time, increasing his/her dependence on the visual system for an accurate assessment of events. This necessary dependence creates problems, as every error in perception can easily translate into an error in action, and the aviation environment is considerably less forgiving than most others. The interpretation of visual information is vulnerable to misinformation, and the academic dissection of the interesting and dangerous effects of visual illusions deserve recurring attention. We describe some of the most common visual illusions in our safety education programs, and they're covered in detail during physiological training courses.

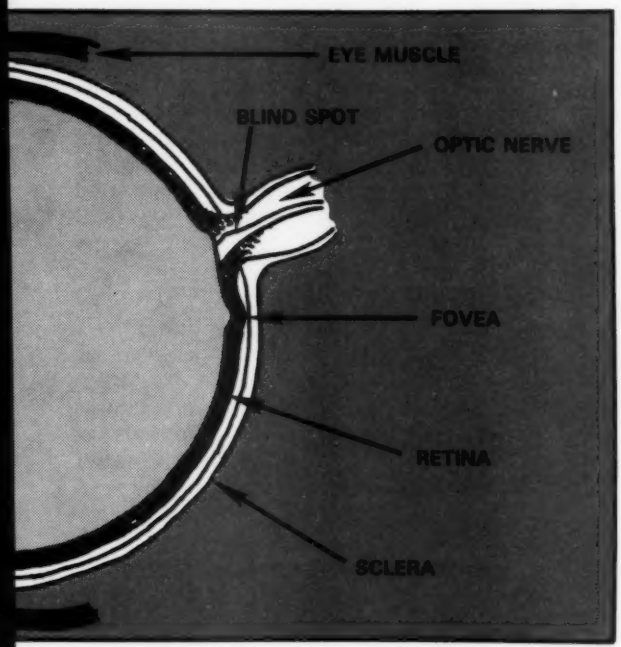
Our priority, for the most part, is on educating fliers about problems with "active seeing," that which results from the integration of visual stimuli within the brain to yield a perspective which makes sense to us. Real or not, the brain *will* make "sense" of what we see. As an example, pick up a pencil and show it to another person, end on, so all they can see is the eraser. If they're like most of us, they will have no trouble at all "manufacturing" the rest of the pencil in their mind, and will correctly identify the device time and again, a testament to the learned, powerful, and active seeing process. This ability to "fill in the blanks" is a fairly handy piece of software to carry about with us. It can create problems when what we see and what really is don't match, but it also gives us the extraordinary ability to see things which are actually beyond our physical ability to bring into focus. When flying low-level over a dry river bed, it's common to see poles standing on either side. On closer examination, one is likely to "see" the cables spanning the sand beneath. To examine this rather common feat a little more closely, we need to briefly review the anatomy and physiology of the eye.



The major anatomical highlights of the eye are shown in Figure 1. The only additional details necessary for our analysis are an understanding of rods and cones. These are light-sensitive cells with chemicals which react to light by breaking down and releasing energy. They are classified by their shapes, with the cones most reactive to bright light, and the rods most sensitive to dim light. The nerve impulses generated by the chemical breakdown in these cells is transmitted to the brain via optic nerves.[1]

The limits of visual acuity are found in a special portion of the eye—the fovea. In this region of the retina, there are no rods, and the cones found here are measurably smaller than those found in the outer regions. This is

by Capt Donald L. Rosenberry
Associate Editor



rather important because the smaller these cones, the smaller the minimum resolution. From the fovea outward, the cones increase in size, and are interspersed with rods, a terrific advantage for night vision. As the rods and cones increase in size, they reach a point, near the periphery, where they are no longer able to resolve objects and can only detect motion.[2] In addition to their small size, the cones in the fovea have another advantage over others in the retina—light passes directly to them. Thanks to some pretty complicated design specifications, the layers of cells normally found over the cones are offset in this area. One final factor that increases our ability to resolve visual stimuli is access to communications. The cones in the fovea have nearly a one-to-one ratio with optic nerves leaving the retina. This compares most favorably to the average for the rest of the eye—around 140 rods and 6 cones per line.[3] With all this said, there are limits to the accuracy of our vision. The "perfect" eye can resolve objects down to .02° (about one minute) of arc.[4] As incredibly small as this may seem, it still leaves out some items important to fliers. The power lines we discussed earlier simply don't disturb a great enough volume of space to be seen from a "safe" distance. So, how did we "see" them?

We depend on the primary visual cortex to extend the limits of our visual acuity through contrast analysis. The idea that an object is easier to see against a background drastically different in color or brightness seems obvious. A more difficult question is, why does contrast make visual acquisition easier?

The answer lies in a specialized portion of the brain. The primary visual cortex is a central locus where all the visual signals our eyes transmit are filtered and translated into useful information with a semblance of spatial organization. Stated simply, the primary visual cortex allows us to distinguish contrast. In its everyday usage, this comes in handy whether walking, trying to determine the edge of your plate, or driving. It also allows us to distinguish alternating shades and intensities which define shape, so we can recognize our spouse (girl/boyfriend) at least eight out of ten times.

In a familiar experiment, you are asked to stare at a piece of paper with a dark shape on it for a couple of minutes. After you've done this, a blank sheet of white paper is substituted for the other. For most of us, the white paper will now appear to have the outline of the shape we stared at earlier, this demonstrates the ability of the primary visual cortex to retain the "shapes" defined by the contrast along the edges. It is exactly this phenomenon, combined with our previously discussed ability to fill in the blanks, that allowed us to "see" the power lines. The greater the contrast, the greater

the impression on the brain, and the more likely we are to perceive the object.[5] Considering light intensity is a powerful contrast value, the argument for aircraft lights as a midair collision prevention device is solid. Getting back to our power lines though, it's apparent that we didn't actually see them so much as we perceived them from other clues.

This reveals a critical flaw in our vision process. What happens when the background doesn't present a significant contrast in color, and you don't see the poles? The unfortunate answer is you won't see the wires, no matter how hard you look; they are simply outside your visual capacity to see, until you're too close to do anything about them. The answer, once again, is in preplanning. Be it in chumming your TPC or performing a premission examination of your "heliport," your life could depend on how much you rely on your eyes alone to keep you clear.

There are other applications to this limitation of the eye. Scanning for other aircraft is difficult enough, since it represents a continuous, monotonous task, without adding the effect that at a significant distance, you can't really see the other aircraft anyway. Here your success relies on your ability to scan effectively and at regular frequent intervals. Having discussed our eye's use of contrast to define spatial relations, the next question is what does the eye do when there's nothing out there to look at?

This is the most disadvantageous of all obstacles to visual scanning. Known as "empty field myopia," the eye reacts in a predictable, although not obvious, manner. When looking out of the cockpit at an empty visual field, there's nothing to stimulate the eye to focus. This is true whether it's a clear blue sky, an overcast condition, or the complete dark of night. The phenomenon has no regard for the degree of general illumination. With nothing to look at, the eye tends to focus at a resting distance, about an arm's length away.[6] This manifests itself most frustratingly when making a conscious effort to scan for other aircraft, only to suddenly find yourself staring at the windscreen! You can overcome empty field myopia by focusing on something outside the cockpit. Whether you use the edge of a cloud or your own aircraft's wingtip, focusing outside the aircraft on something finite will stimulate your eyes to active focusing. Working this into your scanning pattern will improve your visual acquisition tremendously. This process is aggravated at night, since night vision is less effective than day vision.

As mentioned earlier, the fovea allows us our most accurate vision. It is here we can focus on the smallest object. But remember, the fovea is devoid of rods, and this creates a problem for night vision.

Since the cones are sensitive to bright light, night illumination usually isn't strong enough for us to use this portion of the retina. As a result, we can expect, at best, a reduced ability to resolve objects. To make matters worse, there is now a functional blind spot at the position we're most used to focusing with—the fovea. In daylight, the clearest visual picture of an object occurs when we look directly at it; not so at night. The rods aren't effective until about 3° off our normal fixation point, and the area of their greatest concentration (representing the area of finest resolution) is in a circular band between 10° to 15° from the fovea.[7] This makes it even more difficult to perceive objects at night. Not only can we not see objects as small as those we could during daylight, the ones we *can* see disappear when we look directly at them. Obviously, we have to learn to scan for objects at night differently than in daylight, but remembering the empty field problem stays with us. Scary? You bet, and when you combine the problems, like on a low level mission at night, with an overcast sky, you can readily realize how far behind the visual power curve we can be. Preflight planning doesn't fix any of the problems, but knowing our eyes have their limitations will, hopefully, add a little incentive to some of the more "routine" preflight perfunctories.

[1]T. G. Dobie, *Aeromedical Handbook for Aircrew*, (London: National Technical Information Service, 1970), p.135.
[2]Aurthur C. Guyton, M. D., *Basic Human Physiology*, (Philadelphia: W. B. Saunders Company, 1977), p. 628.
[3]Ibid, p. 635.
[4]NTSB/AAR-83/03
[5]Guyton, p. 629.
[6]NTSB/AAR-83/03
[7]Dobie, p. 139.

The Good Old Summertime

by Maj. Thomas C. Weinzierl
Supervising Editor

Well, summer is upon us. The birds are singing, the flowers are blooming, the beaches are crowded, the kids are out of school, and everyone is looking forward to a few months of fun in the sun. But for aviators (and their aircraft), summer is fraught with hazards. A quick review of some of these hazards will help you (and your airplane) beat the heat.

Preflight Planning

The most obvious difficulty encountered in hot weather operation is decreased aircraft performance that results in longer takeoff ground runs. Careful attention to aircraft performance is required. Make sure the weatherman gives you the runway temperature near the runway. Do not use your aircraft's OAT gauge. Loss of an engine in a multi-engine airplane is more critical under hot and high density altitude conditions. Single or three-engine climb capability, obstacle clearance, and maximum takeoff weights must be carefully computed to ensure a safe departure.

Preflight

Summer flying usually means operating in very hot, dry, dusty, and windy conditions. Sand and dust often collect in vital areas of the airplane such as hinge points, bearings, landing gear shock struts, and engine cowlings and intakes. Removal of sand and dust accumulations will help prevent damage to these components. Inspect the tires and shock struts for proper inflation. Be alert for hydraulic leaks. Since high temperatures can damage or distort them—inspect hatch and door seals carefully. Of course, all the protective covers and dust plugs you so diligently installed before your crew rest must be removed. Also, check the area behind your aircraft to make sure there are no vehicles, guard shacks, airplanes, or buildings that could be sandblasted when you start and taxi.

Entering the Aircraft

If you're at a humid location, check aircraft instruments and electrical equipment for excessive moisture. If operating in a dusty location, check for dust accumulations on control, instrument, and electronic equipment areas inside the aircraft. Begin cooling the aircraft according to flight manual procedures using internal or portable

air conditioners as soon as possible. Avionics equipment will function more reliably if the environment is cooled down before it builds up internal heat.

Starting Engines

Most aircraft flight manuals call for normal starting procedures in hot weather. However, be aware that engines may accelerate more slowly under these conditions. Starts may also be "hotter" than usual but should normally stay within limits. Follow procedures closely for simultaneous use of APU bleed air for cooling and engine starts. Withstanding personal discomfort in the cockpit for a short while is better than a hung or hot start due to insufficient air to the starter.

Taxiing

Use the brakes as little as possible during taxi since brake cooling is diminished by high ambient temperatures. Keep sufficient distance between aircraft to prevent sand and dust from blowing into engines. For larger, four-engine airplanes, use, if possible, only the inboard engines for taxiing when the outboard engines are near or past the edges of paved taxi surfaces. Dust or sand raised by the acceleration of engines over unpaved surfaces can damage your airplane as well as others. Check flight control movement several times to ensure unrestricted operation and make sure the controls are drained of water to prevent freezing at altitude. Minimize taxi speed and make shallow turns. Avoid making 180° turns on sun-baked asphalt surfaces. The asphalt should be stressed to take it, but you never know.

Takeoff and Climb

Especially for large airplanes (C-5, C-141, C-130), if gross weight, runway availability, and ambient temperatures permit, set takeoff power with a considerable distance of paved surface behind the airplane to prevent the generation of dust clouds over the approach end of the runway. Strictly adhere to recommended takeoff and climbout speeds because of the reduced performance available in high temperatures. Avoid flying through sand and dust storms. High temperatures will decrease your rate of climb while climb time, climb fuel, and climb range will increase.

Cruise

Pay close attention to fuel consumption during hot weather because reduced performance requires lower cruise altitudes and higher fuel consumption. Even though true airspeeds are higher, that little extra speed could be negated by the requirement to fly lower and carry more fuel.

Approach and Landing

Carefully adhere to normal landing procedures and speeds when landing at airfields where temperatures are extremely high. Beware of the effects of uneven heating of different surfaces under the approach path. Areas covered by water and vegetation gain and dissipate heat differently than bare rocks and soil; this may result in uneven thermal activity. Anticipate longer landing ground rolls due to higher true airspeeds at high pressure altitudes. A combination of high gross weight, high pressure altitude or temperature, and a flap malfunction resulting in a no-flap landing may find you bumping up against your maximum tire limit speed, so check it carefully.

Parking and Shutdown

After a maximum effort landing or a long taxi route to parking, keep people away from the brakes. High temperatures will extend the time required for the brakes to cool. Install chocks as soon as possible and release the parking brake to aid in brake cooling. If you anticipate blowing dust or sand, park the aircraft with the nose pointed into the prevailing or forecast wind (flaps retracted). This may reduce the accumulation of sand and dust along the trailing edge of the wings and on flap, spoiler, and aileron actuating mechanisms. Install all protective plugs and covers to keep out dust, sand, and rain. If on the ground only a short time, open hatches, windows, and doors for natural ventilation except in dusty or rainy conditions.

Crew Rest

Now that you've taken care of your aircraft, find a cool spot, have a nourishing meal and your favorite refreshing beverage to prepare yourself for your next sojourn into the hot and dusty summertime.

A Learning Curve for Instructors

A poorly flown approach can ruin your whole day.

The sweat was still fermenting in the crevices of Capt. Stan Simon's flight suit as he stood in front of the soda machine in the flight operations building. What a flight, he thought. Everything that could go wrong, did—and with a higher-headquarters type on board—yet, watching! His thoughts were interrupted by 2nd Lt. Kent Hasselback's question.

"Sir, should I go over to the debriefing room, or wait here with you?"

"Go ahead, Lieutenant. I've got to finish filling out this MAC Form 97; we'll talk in a few minutes," Stan responded.

"Yes, sir—and, ah, by the way, I'm sorry about the over-temp on today's mission," continued the lieutenant. "Everything seemed to go wrong all at once and . . . ."

"Yeah, well, we'll talk about it in a few minutes," repeated Stan, the frustration beginning to surface in his voice. Quietly, the lieutenant picked up his helmet bag and trudged off to the debriefing room.

Stan knew he would hear about this one. He had just completed a rigorous instructor upgrade course and *thought* he was prepared for *anything*. He knew tactical helicopter approaches in a "Huey" could be tricky, particularly on hot days when power reserves are limited, but he never expected his student to pull collective *and* retard the throttles simultaneously in the middle of a turn at slow speed. Luckily, he'd planned an escape route over descending terrain. Even with this, however, he had to momentarily over-temp the engines of the "N" model and negotiate a dangerously low main rotor speed condition in order to avoid crashing the aircraft. His spirits dropped further at the thought of having to "bite the bullet" in front of the new squadron commander and own up to the fact that he let the student go too far.

"I'll buy you a beer at the club after the debriefing," intoned a voice from behind Stan. Stan wheeled around and was greeted by a reassuring smile from Capt. Brad "Mac" MacKenzie.

"Thanks, Mac. I must admit it would taste good, especially after this afternoon's flight. It was a tough one. I guess I never thought *anyone* would pull collective pitch while they had the throttles cracked back as much as Lieutenant Hasselback did during that turning tactical approach. I should have caught his mistake earlier. By the way, thanks for the 'go-around' call. You must have seen it coming sooner than I did."

"No problem, Stan. You know, there are things we can all learn from this experience. Mind if I listen to the debrief?"

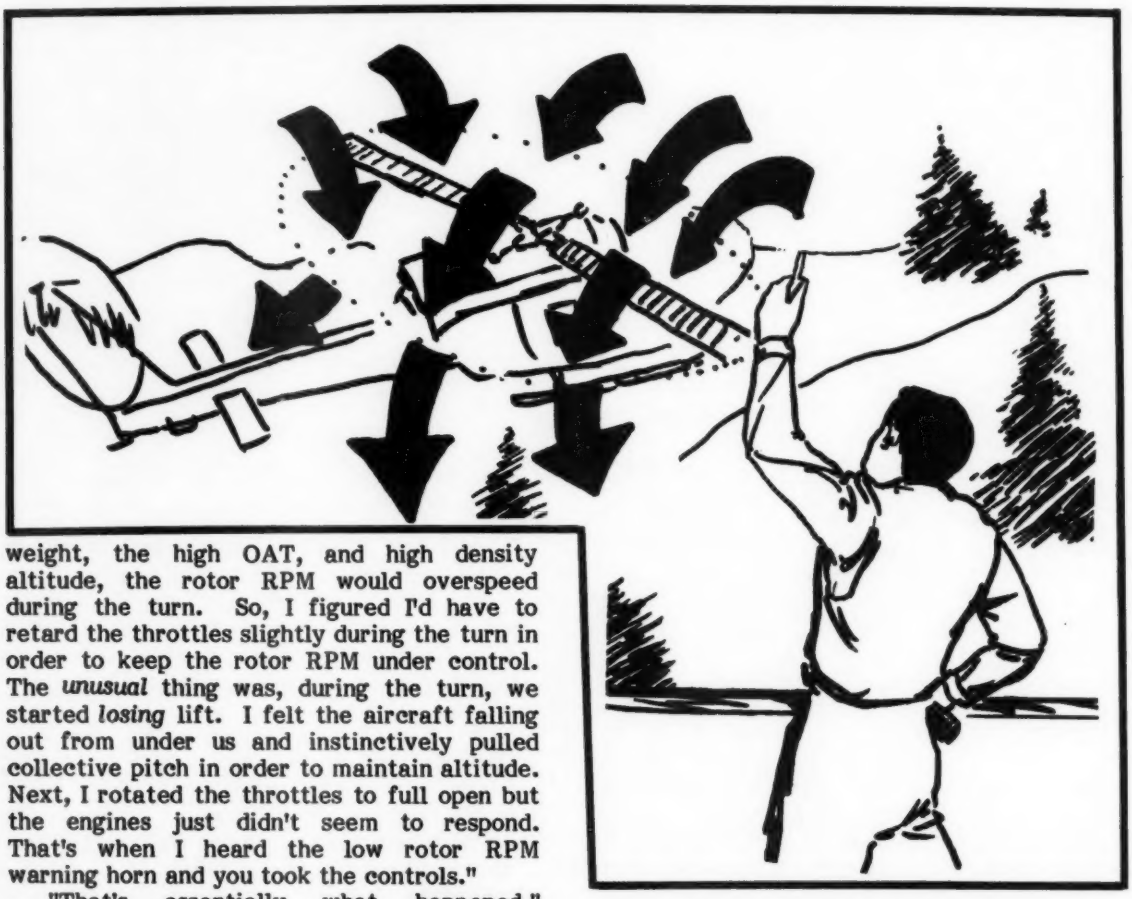
"Ah, no—I guess not," was Stan's hesitant reply. Headquarter's observers always made him nervous. Mac picked up on this reluctance.

"Don't worry, Stan. I don't bite." Mac's friendly countenance helped relieve the tension of the moment.

Stan felt more at ease as he and Mac walked toward the debriefing room. Lieutenant Hasselback sat waiting for what he thought would surely be a scathing debrief. The two captains entered the room, sat down, and Stan opened the lieutenant's grade folder.

"You know, Kent," began Stan, "your flight today went very well up until that last tactical approach. Do you know how you put the aircraft in that situation?"

"Well, sir," Kent responded, "as we crossed over the LZ, I realized I was going to have to execute a turning tactical approach. I also knew that, due to the aircraft's gross



weight, the high OAT, and high density altitude, the rotor RPM would overspeed during the turn. So, I figured I'd have to retard the throttles slightly during the turn in order to keep the rotor RPM under control. The *unusual* thing was, during the turn, we started *losing* lift. I felt the aircraft falling out from under us and instinctively pulled collective pitch in order to maintain altitude. Next, I rotated the throttles to full open but the engines just didn't seem to respond. That's when I heard the low rotor RPM warning horn and you took the controls."

"That's essentially what happened," confirmed Stan. "The important thing is that you recognize the mistake and know how to keep it from happening again. There are several things you need to know in order to insure that it doesn't. First, you attempted an overly agressive turn. When you turn rapidly, you increase the potential of slipping the aircraft out of trim which increases the rate of descent. A rapid turn also decreases your reaction time to unplanned variations in altitude and airspeed and may overstress the helicopter. Also, an overly agressive bank angle may place the rotor blades closer to the ground than your radar altimeter indicates. This can reduce critical ground clearance, particularly if you began the approach from the minimum authorized altitude of 50 feet.

"Second, recognize that if you retard the throttles in order to avert a rotor RPM overspeed, and *then* pull collective pitch, rotor RPM will drop rapidly. At this point, if you return the throttles to full open, engine acceleration time will increase due to the high demand placed on them.

"I think you're going to need a couple more flights emphasizing aircraft control techniques during these tactical, turning approaches. I'll annotate your 670 accordingly. Captain MacKenzie, do you have anything you wish to add?"

Mac leaned forward in his chair and rested his elbows on the briefing table.

"Thanks, Stan. I'd just like to offer a couple of comments. You know, Kent, most pilots, at one time or another, have placed themselves in compromising situations, just as you did today. Some survive; others don't. Fortunately, you turned out to be a survivor. As Captain Simon mentioned, the agressiveness of your turn, and your misapplication of throttles and collective pitch were prob-

lem areas in this mishap. But something else you should consider is the effect relative wind had on aircraft performance.

"Let's take a look at the wind speed and direction in relation to the angle of attack of the main rotor blades. Here, let me illustrate." With that, Mac stepped to the chalkboard.

"One of the reasons you elected to perform a 180° turning approach was to align your final approach course into the wind. During flight, from the IP to the LZ, we determined the wind was at our 6 o'clock at about 35 knots. You started decelerating on downwind so when you began the turn your airspeed was approximately 45 to 50 knots and decreasing. Due to the agressiveness of the turn, you began to feel the effects of the downflow of wind through the rotor system. This accounts for the aircraft "falling out" from underneath you. What really happened is this downflow reduced the angle of attack of the main rotor blades.

"This change in angle of attack, combined with the increased power demands of slow flight, required you pull significantly more collective pitch than you had planned. The situation was aggravated by the left turn and became almost deadly when you induced a low rotor RPM condition by increasing collective pitch with the throttles reduced. Then the number-one engine exceeded maximum inlet turbine temperature.

"Now we were out of altitude, airspeed, and rotor RPM, *but not* good ideas. Fortunately, Captain Simon had selected a suitable escape route, took the controls of the aircraft, and safely recovered.

"Keep in mind that although this situation happened during a tactical approach in an "N" model, the lessons learned about downflow and angle of attack apply to all helicopter turning approaches with a strong tail wind. The margin which separates the successful approach from the disastrous one in these conditions is built on solid knowledge of helicopter aerodynamics, properly applied. Do you have any questions?"

Both Stan and Mac could see from the look on the Lieutenant's face that he understood. "Then what I should have done was reduce the turn rate to minimize the downflow effect and made sure the throttles were full open *before* I pulled collective pitch."

"Exactly," replied Stan. "We'll work on this maneuver during tomorrow's flight. Unless you have any other questions, you can call it a day."

Lieutenant Hasselback picked up his gear and departed. Stan turned toward Mac, who was busy cleaning the chalkboard. "I appreciate your comments, Mac. I'm just sorry the situation happened at all. I should have seen it coming."

"Don't be so hard on yourself, Stan. The important thing is you learned from this experience. You know what they say; as an instructor, you can never let your guard down. This situation snuck up on you, and that's something you can't afford to let happen.

"Remember, you set the example for your students! If you *anticipate problems* before they happen—and then take action to make sure they don't—chances are, this *safety attitude* will carry over to your students. If you're anything like me, I'm sure you can remember pilots who always seemed to be behind the power curve when it came to thinking ahead of the aircraft. Hopefully, we can use their bad example to make us and our students better pilots and IPs.

"I'm glad you selected an escape route with descending terrain, but, as I'm sure you realize, you let your student go too far. One reason for this may have been that, up until this last approach, Lieutenant Hasselback's performance throughout the flight had been outstanding and may have given you overconfidence in his ability, a normal response—but potentially fatal. Also, I know you were aware of the wind speed and direction and its resulting effect on aircraft performance. But, you should make sure your student understands this.

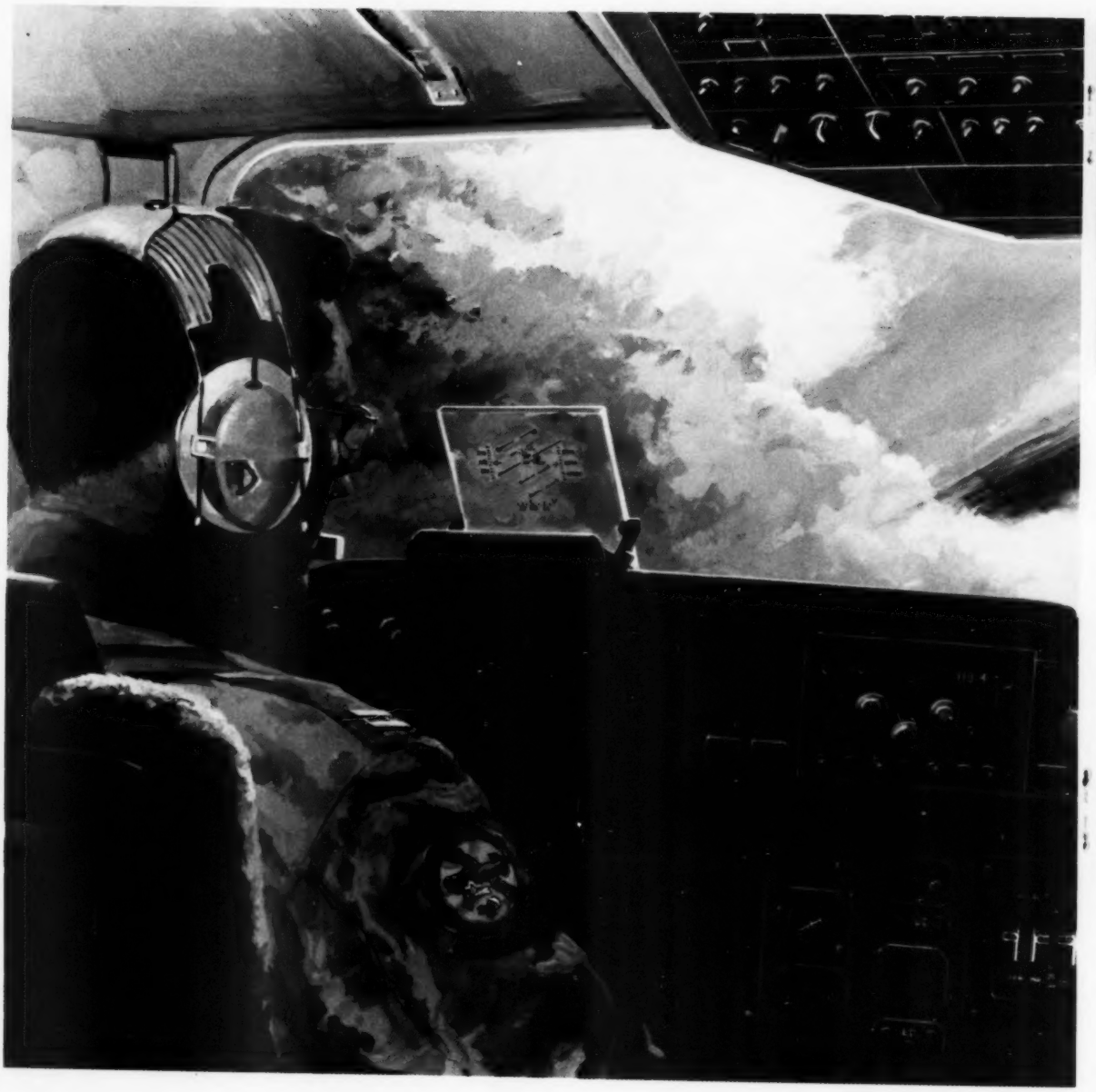
"Your skill in dealing with this situation proved to be the deciding factor whether we flew home or scraped ourselves off the ground. Unfortunately, you had to over-temp an engine in the process but the price could have been much higher."

"I think you're right, Mac," responded Stan. "One thing is for sure—I'll be on guard next time."

"Good," replied Mac, "Now, how about that beer?"

"Ah, sure Mac. But first I've got to stop by and explain this situation to the DO."

The C-17 — *A Lo*



ook Ahead

Adapted from an article by Mr Ken Millikin,
Douglas Aircraft Company
Long Beach, CA

It's black as a witches' hat outside. There's no moon, and the rain is falling from the heavy cloud cover at about an inch an hour. Through the HUDs (Heads-Up Displays) we can see the terrain slide under us as we streak along at 350 knots. Even though we're on autopilot, having everything right there on the HUD is reassuring.

We're a six-ship formation, kept apart and out of the dirt by a bunch of micro-chips in the flight computers. All six airplanes are coupled to the station keeping radar system. Our call sign as number 2 in the formation is Loader Twelve. Suddenly our formation leader, Loader Eleven, breaks through on the secure interplane frequency. "Loader Eleven to flight. We took a hit."

The auto-SKE FCIs (Flight Control Indicators) show a 20-knot slowdown. Second element lead relays with a single keystroke. No more ground fire. Probably just a lucky hit.

"The computer shows we lost part of our electronics and partial power on number three engine. We're still operational. What do we look like from outside?"

As we move up to a wingtip position to scan, Loader Eleven glows green in the night vision goggles.

"Loader Eleven, this is Twelve. No smoke or oil visible. I can see a small tear in the skin on number-three. Do you want a lead change?"

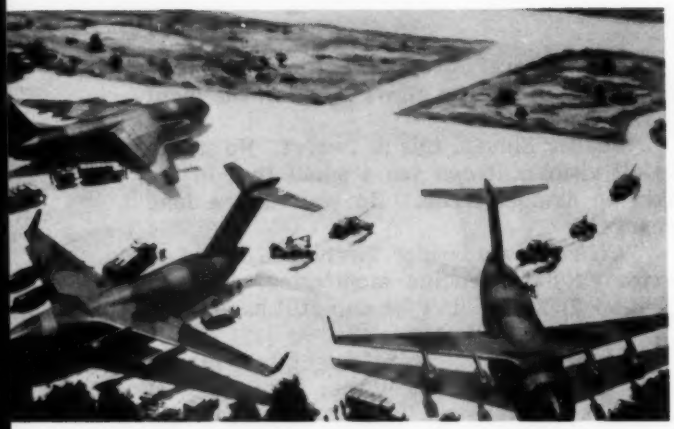
"Affirmative, Loader Twelve. We need an extra CRT for engine monitoring, so we'll give up SKE lead, but we can still handle the drop."

The lead change went smoothly. Eleven drifted back to number-three, we moved up to lead, and number-three moved over and assumed deputy lead. Only a few words were spoken on interplane, but we all knew what Loader Eleven was going through. You can damage an engine and lose half the electronics on a C-17, and the only evidence will be a few lights in the overhead "lights-out" systems panel. The computers can bypass all the equipment that got hit, switch in a redundant systems, trim the plane to compensate for the weak engine, and run through the automatic isolation routines. The stick and pedals will still feel normal. The plane will respond crisply. You'll notice you lost a little thrust, but other than that it will fly like a brand new three-engine airplane.

Right now Loader Eleven's pilots are looking at the pattern of lights on the overhead panel to see what they need to do for cleanup. The copilot presses the lighted buttons one by one and the panel returns to its normal "lights-out" condition. The status page on the mission computer reads, "NO SKE LEAD—NO LAPES." Other than that, the bird is FMC.

On Loader Twelve, we amend our mission computer flight plan to make good our TOT, engage the speed Nav, and the formation is recoupled. Loader Eleven confirms he can maintain speed and position.

Yesterday, we dropped two Bradley Fighting Vehicles (about thirty tons each) into a patch of sand a thousand miles away using our LAPES equipment. Today, we'll drop heavies to support the airland offensive, then split up and recover at dispersal fields to offload our wing fuel and back haul casualties and troops. Our airdrops are right on the numbers.



Right now, we're looking for our LZ, a wide spot in the road that should be . . . there it is. That parking ramp does look small, doesn't it? One in ahead of us already. We may have to back it in.

Time to descend. Autopilot off . . . full reverse . . . slow to two-fifty . . . reversers back in . . . half flaps . . . gear down and here comes the visual glide slope reference on the HUD. We're right on the 5° approach angle. No record, but 59 seconds from 350 to 130 knots isn't bad . . . full flaps and down to 115 knots. The controls are still crisp and responsive. We're well above stall speed with lots of margin over Vmca. We can see our aim point on the HUD. A heavy load into a short field doesn't have the "pucker factor" it used to.

The touchdown is a little long, maybe 50 feet. Well, we still have 2,500 feet of dirt road left. At 100 knots that's plenty. The old saying, "One of the most useless things in the world is runway behind you," makes even more sense today.

The C-17 steering system is great. The reversers make a 180 as easy as parking a car. The 90-foot wide runway today makes things easy. That 60-footer the other day was right on our limit, but we handled it okay. The HUD makes it a cinch to get into fields like that. This is really a bare base. No ground handling equipment at all. Here the C-17's capability to back up will come in handy again. Even with a full load, the reversers let us back up a steep incline.

Engines running offload and onload will be the drill today. The reversers angle the exhaust up and forward so the loading crew can move about behind the airplane without getting blown away. With the APU out of the way in the tail section, we can keep everything powered up and ready to go. Time to sit back and take a breather.

C-17 - Built in Safety

The mission scenario just presented is a typical demonstration of the capabilities of the C-17. The C-17 will be able to handle any kind of load, from paratroopers to nuclear ordnance. One of the best uses of the airplane, however, is carrying heavy wheeled and tracked vehicles to forward areas.

The innovative features mentioned are all based on proven, reliable technology. By the time the first C-17 is in the air, the engine series will have over 6 million hours of service on Boeing 757s. The power flaps were proven on the YC-15. The controls are a lot like those on the KC-10. The flight guidance autopilot-autothrottle gives the airplane a lot of unique capabilities, but they've been around in newer generation commercial planes for years. The C-17 will incorporate the latest developments in airplane technology.

Some of the technology looks like it came out of a fighter, but it is designed and adapted for the airlifter. For instance, there's a button on the stick that allows the pilot to set and maintain a desired pitch angle. Zero degrees (dead level) for LAPES, heavy extraction, and troop drops. Five degrees to slide containers out the back for a gravity drop. It will also hold the wings level automatically. The HUDs are full capability. They not only show airdrop and navigation symbology, but they also give instrument flight information. The HUDs are ideal for low visibility approaches in Category II conditions.

The C-17 will be manned by a three-person crew, two pilots and one loadmaster. To make it possible for a crew this size to handle the airplane, cockpit instrumentation has been computerized to reduce workload. Four color CRTs called MFDs (Multi-Function Displays) are used in the cockpit to display information the pilots need. A single button allows the pilots to change the displays as required. All four MFDs are identical and interchangeable. If one is damaged or inoperative, you can shift over to

one of the other three. In fact, you can function at almost 100 percent with only *one* of them. The CRTs replace over 45 instruments and indicators necessary in other airplanes.

With all those electronics on board, it's only natural to worry about failures and battle damage. Every control surface on the plane is fly-by-wire. Each control has a separate, redundant electronic system, and every system, with the exception of the spoilers, has a mechanical backup. To knock out the pitch control electronics, for example, two separate systems would have to be hit, each with redundant channels, each in a separate location. If all four channels go, you're back to the pitch control on an ordinary cargo plane. The other controls will still be fly-by-wire.

The first level of electronics failure is fully protected by in-depth redundancy. Additional failures bring about "graceful degradation." The systems are designed for a gradual loss. If all the electronics are knocked out, you'll still have the basic instrumentation and controls used on today's airlifters. You can still fly the airplane home safely. The mission may be in trouble if you lose all electronics, but the plane and crew will still survive.

Of course, total failure of the electronics is a remote possibility. It would take 10 simultaneous failures in 10 separate locations just to knock out the fly-by-wire. The computers will also handle in-flight isolation procedures, automatically switching in backups faster than the crewmember could.

Other systems also have extensive redundancy built in. The airplane would have to be almost destroyed to take out all the redundancy in any one system. For instance, look at the electrical controls. Each solenoid has two independent coils. One operates from the flight deck, the other from the cargo compartment. And there are two solenoids for each function, with the wiring on different sides of the airplane. There are hydraulic backups in the unlikely event the solenoids are completely knocked out.

The C-17 will have four complete hydraulic systems, with main and auxiliary pumps for each system. An electric pump allows pressure transfer between number 2 and number 3 systems in either direction. If all that gets blown away, a sump reservoir will get the rear door open and closed, along with a few other odd jobs.

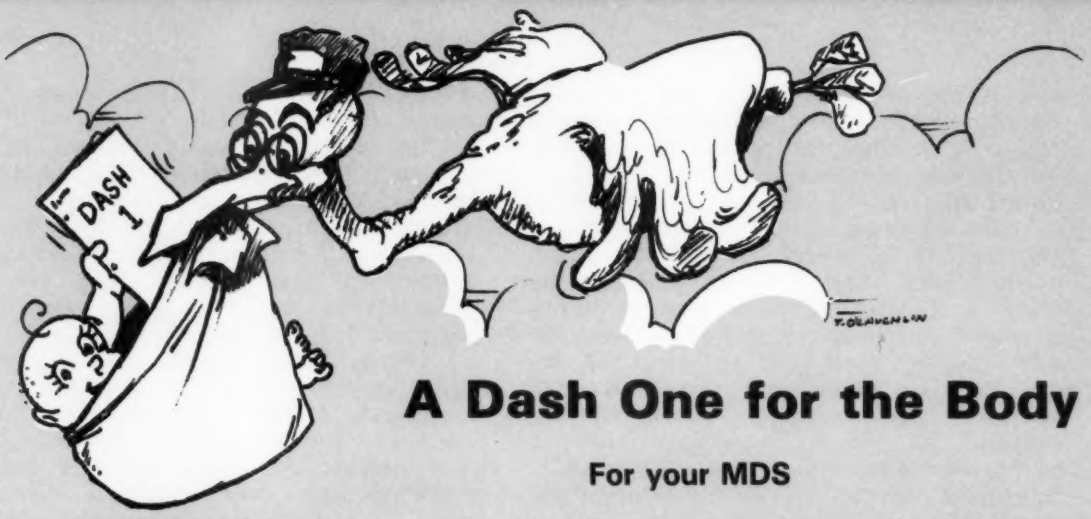
The same redundancy applies to the airplane's electrical system. The airplane is powered by six generators and four alternators. An automatic bus tie reconnects the system if a generator is knocked out. If the cockpit panel didn't tell you the generator was out, you'd never know it had been hit.

Airdrop systems also have safety backups built in that allow the pilots and the loadmaster to keep the operation flowing smoothly. For example, the pilots have the best view of the extraction zone during a LAPES drop, so they release the extraction chute. But the loadmaster has the best view of what's going on while the extraction chute deploys, so he needs to control the operation, too. If the extraction chute becomes fouled, the loadmaster can safety the system, relock the load with the floor pallet locks, and disarm the panel. The loadmaster can jettison the load, too, if necessary.

That sounds like a lot for only one loadmaster, but the C-17 is *designed* for a single loadmaster. The loadmaster has two complete control panels, one forward, one aft. He also has remote control of the cargo winch and the retrieval winches, so he can manage the operation from the best vantage point. The C-17 has specially designed fixtures for carrying just about anything, rolling stock, pallets, platforms, personnel, or paratroopers. The aircraft can also be configured for MEDEVAC missions. The C-17 loadmaster will be better organized, have better control of the operation, and not be as physically stressed as other loadmasters.

There is one other feature of the C-17 that will enhance survivability. Kevlar armor extends from the floor to above the side troop seats to protect cargo compartment occupants from small arms fire and shell fragments.

Design safety is one of the C-17's keys to mission success. With a smaller, better protected crew, the C-17 will offer MAC the capability to resupply forces "up-front." In-depth redundancy, workload management, graceful degradation, and simplified procedures will increase the chance that the crew and airplane will be able to do the job safely and return to do it again.



A Dash One for the Body

For your MDS

by Maj. Thomas C. Weinzierl
Supervising Editor

Wouldn't it be great if the doctor sent our parents, along with his bill, a Dash One type manual spelling out procedures for the care and feeding of their brand new human being after each of us was born? It could be updated throughout our lives as we progress from infancy, childhood, and adolescence, to adulthood. Now that we're all (legally anyway) adults, a look at our imaginary Dash One may help us examine how to take care of ourselves and how to prevent exceeding our limitations (and what to do if we do).

Section I - Description and Operation

A human is a frail creature, susceptible to myriad ailments, mishaps, internal and external disturbances, and the vagaries of environmental conditions. However, the human is also a most adaptable creature. The human body is able to adjust to a variety of adverse conditions and continue functioning even under extreme pressure.

Interior Arrangement

The human body is composed of separate, but interrelated systems that maintain stasis--constant conditions in the body.

The Respiratory System

Each time blood is pumped through the body it also passes through the lungs. The blood absorbs oxygen through the thin membranes of the alveoli, acquiring oxygen needed by the body's cells. Maintaining respiratory efficiency through proper exercise is vital to the body's overall well-being. At the same time blood picks up oxygen in the lungs, carbon dioxide is released from the blood through the lungs and the movement of air into and out of the lungs carries the carbon dioxide out of the body.

The Gastrointestinal Tract

A large portion of the blood pumped by the heart passes through the gastrointestinal organs. Here, different dissolved nutrients, including carbohydrates, fatty acids, amino acids, and others, are absorbed into the fluid surrounding the body's cells. The proper foods to be supplied to this area will be covered in Section II - Normal Procedures.

The Liver and other Organs

Not all substances absorbed into the bloodstream in the gastrointestinal tract can be used in their absorbed form by the cells. The liver alters the chemical compositions of many of these substances to more usable forms. Other tissues of the body--such as the fat cells, the kidneys, and the endocrine glands--help to modify the absorbed substances or store them until they are needed at a later time.

Musculoskeletal System

The musculoskeletal system provides the body with mobility, allowing it to move to the appropriate place at the appropriate time to obtain food. It also provides mobility for protection against adverse surroundings. Proper conditioning will enable the body to perform the aforementioned tasks.

Section II - Normal Procedures

To prevent undue complications, this

section will only refer to procedures applicable to normal operation of the human body.

Weight and Balance

In order to maintain the human body at or near its optimum operating weight, the operator must take positive steps to ensure the body is provided a balanced diet containing the proper nutrients, minerals, and vitamins.

The operator should eat meats low in saturated fat, such as chicken (without the skin) and fish, instead of beef, lamb, or pork. The operator should choose lean cuts of red meat, and trim any visible fat. Fruits, nuts, (preferably dry roasted) and raw vegetables make healthy between-meal snacks. Grains and starchy foods provide needed vitamins, minerals, and fiber.

CAUTION

To reduce the possibility of exceeding weight limitations and contamination of body plumbing (arteries) with cholesterol, use liquid vegetable oils and margarines high in polyunsaturated fats. Avoid fatty luncheon meat and organ meats, including sausage, salami, bologna, brain, liver, and kidney, as they are high in fat and cholesterol.

NOTE

To reduce fat consumption prepare foods according to the following methods: broiling, boiling, roasting, and stewing.

Fluids

Maintaining the body's proper chemical balance requires the consumption of sufficient amounts of the proper liquids. Water is the most suitable liquid for replenishment of cellular fluid, while fruit juices also provide some vitamins and minerals vital to the body's chemistry. Regular ingestion of water and fruit juices is also necessary to prevent the onset of dehydration, a fact for bodies participating regularly in aeronautical activities to remember.

CAUTION

Avoid ingesting liquids containing high levels of caffeine or alcohol, as they contribute to dehydration.

Diet

The human diet should contain a variety of foods because no single food supplies all necessary nutrients and because many nutrients work together in the body. About 50 nutrients are needed daily for optimum operation of the body. If the 10 leader nutrients are in the body's daily diet, the other 40 or so nutrients will likely be consumed in amounts sufficient to meet the body's needs. The ten leader nutrients are: carbohydrates, protein, fat, calcium, iron, and vitamins A, B1, B2, C, and niacin.

Section III - Emergency Procedures

The procedures contained in this section are considered the best for coping with the various emergencies that may be encountered during operation of the body. The primary consideration during any emergency is MAINTAIN BODILY CONTROL. Analyze the emergency and take proper corrective action.

Colds and Respiratory/Sinus Difficulties

If you feel the onset of these conditions, take the following actions:

1.DO NOT FLY.

2.See your Flight Surgeon ASAP.

3.Take prescribed medications as directed.

Heat Stress

If you begin to experience adverse effects of high temperatures as evidenced by a feeling of weakness, cool, clammy skin, fatigue, mental confusion, and cramps in muscles being exerted:

1. SLOW DOWN.
2. Drink more water.
3. Eat sensibly—a low protein diet will lower the body's production of heat.
4. Don't overdo it.
5. If you really feel bad, SEE A FLIGHT SURGEON.

Hypoxia

If you experience any of *your* body's symptoms of hypoxia while engaging in aeronautical activities:

1. DON OXYGEN MASK—set regulator to 100% Oxygen.
2. Maintain airplane pressurization below 10,000-foot cabin altitude or descend to an altitude not requiring oxygen.
3. See a flight surgeon as soon as possible.

Fatigue

If you recognize physical signs of fatigue, such as muscle aches, poor coordination,

headache, chills, nausea, washed-out complexion, dull or bloodshot eyes, slurred or slowed speech, continued yawning, slowed or inappropriate reactions, inattention, or nodding off:

1. Obtain adequate rest.

2. Eat a proper diet. Protein provides more energy over the long haul. Carbohydrates provide quick energy and may be suitable for a quick boost.

3. Drink more liquids. Water, juices, and milk (especially skim milk) are best.

4. Exercise. Simple calisthenic exercises can help you wake up.

Hypoglycemia

To prevent possible degradation of performance due to hypoglycemia (low blood sugar) and increased susceptibility to reduced tolerance to hypoxia, G forces, and spatial disorientation:

1. Eat light, well balanced meals, every four to five hours.

2. For between meal snacks, raw vegetables, especially carrots, are more effective in raising blood sugar than candy.

Section IV - Crew Duties

You are responsible for the proper maintenance and operation of your body. The following steps will help you fulfill this responsibility.

1. Obtain adequate rest. All body systems need a periodic respite to maintain peak efficiency.

2. Exercise regularly. Regular aerobic exercise is necessary to maintain your heart, lungs, and other systems in good condition.

3. Eat a balanced diet. Maintaining proper body weight and chemistry is vital to maximizing body service life. Cut down on salt and cholesterol.

Section V - Operating Limitations

Limitations presented are required to maintain the loads imposed on the body within 100 percent of the design limit load levels. Section V does not contain ALL limitations. Some limitations are covered in sections dealing with that particular specialized operation of the body.

Weight Limitations

Consult your Flight Surgeon for the maximum and recommended weight limit for your particular MDS (Mission, Design, Series) body. However, the following guidelines present a way to *estimate* your appropriate weight:

Women—Allow 100 lbs for the first 5 feet of height. Add 5 lbs for each inch over 5 feet.

Men—Allow 106 lbs of the first 5 feet of height. Add 6 lbs for each inch over 5 feet.

Prohibited Maneuvers

1. Don't fast to lose weight. A gradual loss is more effective.

2. Don't self-medicate. Self-prescribed medications may have undesirable side effects, particularly when participating in aeronautical activities.

3. Don't overindulge in alcoholic beverages. Drinking too much contributes to high blood pressure, dehydration, hangovers, reduced resistance to fatigue, and may hamper restful sleep.

4. Don't smoke. Smoking raises blood pressure, impairs night vision and reduces resistance to hypoxia.

5. Don't overeat. Consuming calories in excess of that burned every day may result in exceeding weight limitations. (Refer to Prohibited Maneuver #1 above.)

Section VI - Flight Characteristics

The human body is designed to provide many years of operation. A body exhibiting good stability and moderate habits, along with regular exercise and adequate rest, should meet or exceed its design service life.

Section VII - Adverse Weather

Although the human body appears frail, it is really quite ruggedly built and can withstand years of hard use. However, it must be protected from extremes in temperature and harsh weather.

Hot Weather and Desert Operation

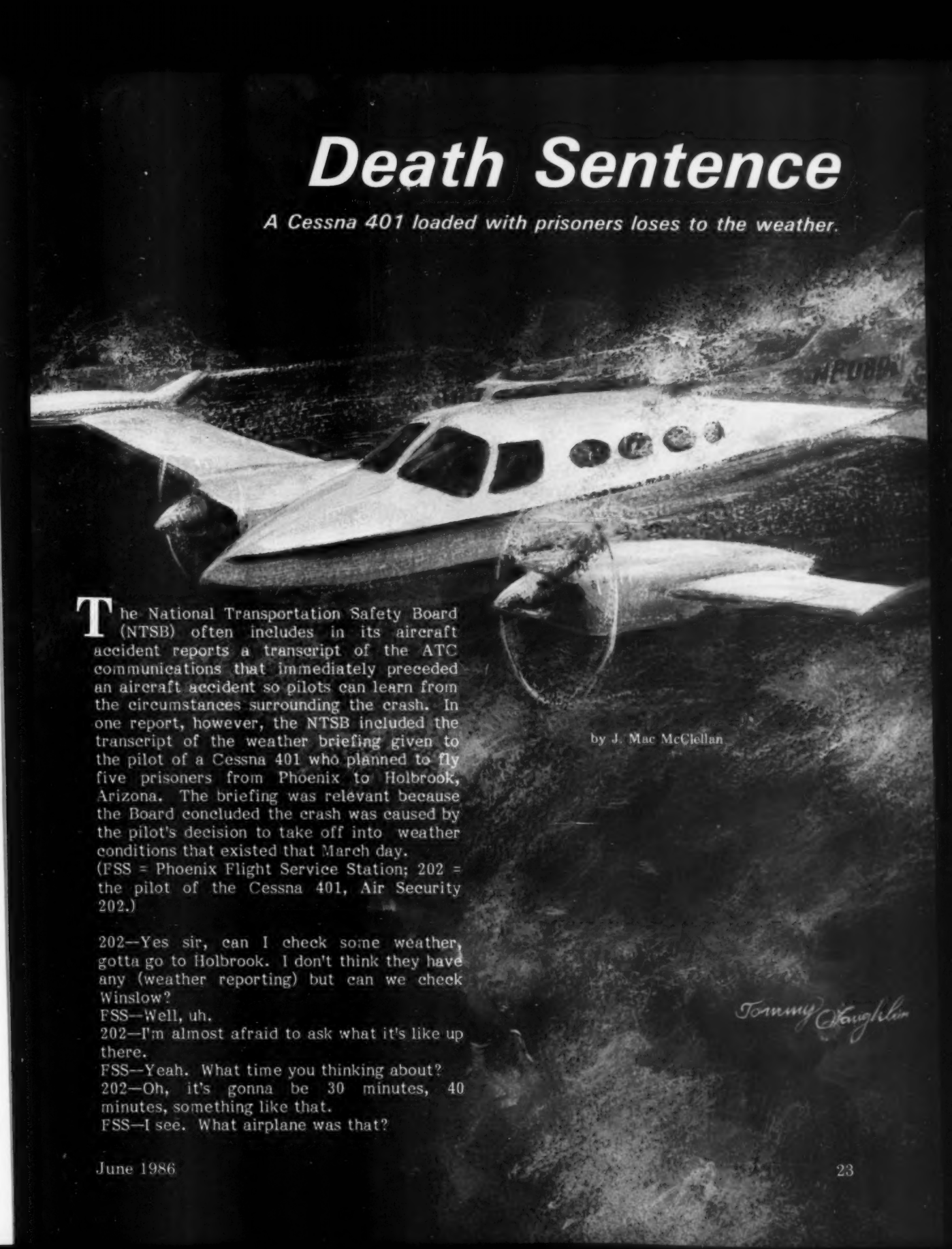
Protect the body from the effects of the sun by wearing protective clothing to avoid sunburn. Heat stress is the greatest hazard from hot weather. For procedures to counter heat stress, see Section III.

Cold Weather

Ice, snow, wind, rain, sleet, and fog prevalent during winter weather present a constant challenge to the human body. Proper clothing and limited exposure to extreme conditions are the best measures for surviving cold weather.

Death Sentence

A Cessna 401 loaded with prisoners loses to the weather.

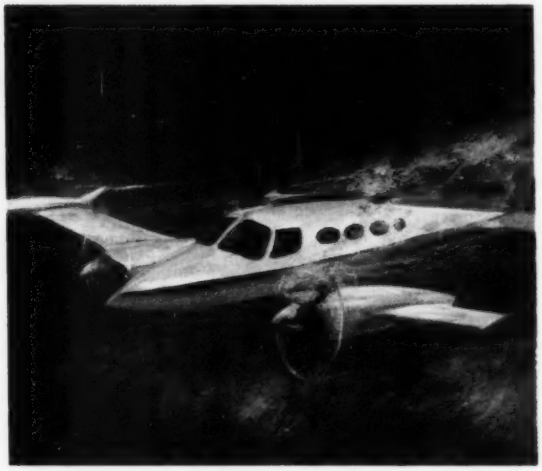


by J. Mac McClellan

The National Transportation Safety Board (NTSB) often includes in its aircraft accident reports a transcript of the ATC communications that immediately preceded an aircraft accident so pilots can learn from the circumstances surrounding the crash. In one report, however, the NTSB included the transcript of the weather briefing given to the pilot of a Cessna 401 who planned to fly five prisoners from Phoenix to Holbrook, Arizona. The briefing was relevant because the Board concluded the crash was caused by the pilot's decision to take off into weather conditions that existed that March day.
(FSS = Phoenix Flight Service Station; 202 = the pilot of the Cessna 401, Air Security 202.)

202—Yes sir, can I check some weather, gotta go to Holbrook. I don't think they have any (weather reporting) but can we check Winslow?
FSS—Well, uh.
202—I'm almost afraid to ask what it's like up there.
FSS—Yeah. What time you thinking about?
202—Oh, it's gonna be 30 minutes, 40 minutes, something like that.
FSS—I see. What airplane was that?

202—It's a Cessna 401.
FSS—Yeah. Well (unintelligible) take my barf bags along.
202—Oh, really.
FSS—You got a trough moving into the area from the west and it's into the north end of the valley, at least the pre-cloudiness associated with it is, and it's right down to the ground. We're starting to see quite a bit of mountain obscurement up to the north of here.
202—Uh huh.
FSS—There's a batch of sigmets out (unintelligible) this way. You can look for at least moderate icing in clouds or in precip above the freezing level.
202—Okay.
FSS—And I guarantee you moderate to severe turbulence (unintelligible).
202—We had that coming up (chuckle).
FSS—Yeah. You're looking at lowering ceilings moving into the area from the west. The last reports I got here, here's a Cessna 402 along Victor 190 up towards St. Johns (VOR).
202—Okay.
FSS—And he's reporting bases of the overcast now at 9,500 msl, tops 12,000 to 13,000 and he had light rime at 12,000.
202—Ouch.
FSS—Now that's still quite aways in advance of your trough.
202—Yeah.
FSS—The system is right getting into the local area now. I mean it could be on you before you're out to the airplane. I can't give you a hard fast (unintelligible).
202—I could see it as we were coming in.
FSS—Yeah.
202—It's just a little bit to the east of here from what it looks like (unintelligible).
FSS—(Unintelligible) to the west (unintelligible).
202—(Unintelligible) (chuckle).
FSS—Don't scare me that way. Anyway, once it gets on top of you, you can forget VFR flight.
202—Yeah.
FSS—Ah, and it's moving fairly rapidly across that route, and I don't particularly, I don't recommend VFR flight.
202—Yeah, well.
FSS—From an instrument standpoint you're talking about thunderstorms, embedded thunderstorms, you're talking about severe ice once it moves over (unintelligible).
202—Yeah.
FSS—And continued severe turbulence, widespread mountain obscurement and parts of northern Arizona sound like something from Hades inferno.
202—Oh, oh.
FSS—Extensive areas of snow and fog with rain and snow mixed and locally heavy snow, ah, be increasing over the entire area past 11 a.m. Mountains totally obscured with bases around 5,000 msl getting up to Holbrook anyway.
202—Yeah, they don't even have an approach up there.
FSS—No, that's what I say (unintelligible). You can shoot the approach up there at, uh.
202—Winslow.



FSS—At, uh, Winslow, maybe and sneak across (unintelligible) sometimes but I don't even recommend that today.
202—No, no.
FSS—Matter of fact, terminal forecast at Winslow is for, uh, right now, ceiling of 5,000 broken, surface winds out of the southwest at 20 knots gusting to 45 knots with visibilities to a mile in blowing dust.
202—It's going to take me 40 minutes to get up there too.
FSS—Yeah, and then once this thing crosses over, you're looking for ceilings no better than 3,000 and 3.
202—Yeah.
FSS—And snow pellets with occasional ceilings of 500 and a mile in snow pellets.
202—Okay.

FSS—(Unintelligible) out to the east, you know.
202—No problem.
FSS—You're going to get your teeth knocked out.
202—Yeah.
FSS—You probably got enough ceiling as long as you try to stay ahead of this thing (unintelligible).
202—Yeah.
FSS—(Unintelligible) is strictly a north-south-oriented line and it could very well cross your route. I doubt seriously you got an out. You can go east some way, but I don't know how they feel about that either.
202—What does Amarillo (Texas) look like right now?
FSS—Well, the further east you go, the better it gets. Amarillo is 10,000 scattered with cirriform overcast. Looking back, Albuquerque carrying ceilings 9,000 broken with a little shower. Tucumcari (New Mexico) pretty good too, 12,000-foot ceiling. There is a thunderstorm over around Tucumcari.
202—(Chuckle).
FSS—It's just (unintelligible).
202—Okay, just trying to decide if I—I don't know—if I could go east and then cut back in from the other side.
FSS—Well, that's what I'm saying is (unintelligible). I don't think you're gonna. It's because, uh, my reports right now indicate, uh (unintelligible) timewise, otherwise this thing is moving at a pretty good clip. Now, it had slowed down but it is picking up some speed as it comes across here.
202—Okay.
FSS—And, the severe weather right now I'd place, well let's see if we can pin the eastern edge of that thing down here a little bit. Hold on a minute.
202—Okay.
FSS—Okay, it's east of Blythe (California), it's east of Flagstaff and the (Grand) Canyon.
202—Uh, huh.
FSS—But it hasn't reached Gallup or Farmington (New Mexico) yet. Winslow, well they got that autob (automatic weather reporting) up there and it isn't worth too much. Yeah, I've had it, I've had guys on the ground say they couldn't see their hands in front of their face and the Winslow autob said clear below 6,000. That's what it's saying now but I'm looking at the surface winds. They're starting to pick up pretty good. That's been a pretty good indicator that the weather is getting into that area right now. Winslow surface winds are 190° at 23.
202—Okay, how fast?
FSS—Gust to 33.
202—How fast is that supposed to move through?
FSS—Uh, (unintelligible) I'd say you're probably gonna get yourself a vacation for a day or so here. It won't be through here until tomorrow.
202—Okay, and, uh, I got a problem. I've got an Aerostar that's headed for California, San Francisco, and he's going to be right in the middle of this stuff.
FSS—Oh, boy.
202—I'm supposed to meet him at either Holbrook or Amarillo and just wait a day and take a vacation.
FSS—(Chuckle) Well, yeah, of course you'll have to put up with that thing, you know. If you go to Amarillo (you're) gonna have to wait on it to come through there then (unintelligible).
202—Yeah, okay, well let me go reconnoiter and then I'll give you a call back.
FSS—Okay.

The Cessna 401 pilot called back less than 15 minutes later and asked for winds aloft at 12,000 and 15,000 and filed a flight plan to Amarillo. The Phoenix FSS briefer gave him the winds at 12,000 and 18,000, which were 220° at 52 knots and 220° at 78 knots. The pilot then filed a flight plan on Victor 190, exactly along the route that had been discussed in detail during the briefing recorded on the NTSB's transcript. The pilot told the second briefer that he had already been briefed and declined the offer of additional weather information.

About one hour after the pilot filed the flight plan, the Cessna 401 departed Phoenix Sky Harbor Airport and was cleared to climb to the filed altitude of 13,000 feet on Victor 190. Communications were routine until the 401 pilot reported an engine problem and declared an emergency as he was climbing through 11,000 feet. In 30 seconds the airplane descended through 8,500 feet and a short time later radar contact was lost as the airplane descended through 6,500 feet.

The 401 crashed into rugged terrain at an elevation of 3,700 feet 31.5 nm northeast of the Phoenix VOR. The pilot, guard, and two prisoners were killed in the crash. Three prisoners were seriously injured.

An airline crew on center frequency tried to relay communications during the 401's descent. There was confusion over which engine was causing problems in the 401. One report indicated the left engine and another the right engine. Examination of the wreckage revealed a hole in the right engine turbocharger, causing it to leak exhaust gas. This would cause some power loss at altitude but, by itself, would not constitute a catastrophic failure of the engine. The surviving prisoners were interviewed and only one of the three that survived the crash said that there was anything unusual about the sound of the engines. However, all survivors reported a very turbulent flight. Examination of the wreckage did not reveal a reason why either engine would not have been operating.

Given the evidence, the NTSB ignored the report of engine problems and blamed the crash on the pilot's decision to fly into known adverse weather, operation of the airplane without certification for flight into icing conditions and wing ice. The board ruled that rain, turbulence, and ice were all factors related to the crash.

The NTSB had its own analysis made of the weather conditions that existed at the time and determined that the forecasts and reports provided by the FSS briefer were accurate. Using data from weather radar, the NTSB determined that ice could have built at a maximum rate of .2 inch per minute if the 401 was climbing at a true airspeed of 120 knots. That estimate jibes with reports of moderate to severe icing filed by other pilots descending into Phoenix. The 401 was equiped with leading-edge boots and propeller anti-icing equipment but, as was common in 1968 when the aircraft was built, was not certificated for flight into icing conditions.

It seems clear that the 401 pilot either did not believe or did not understand the definitions of severe turbulence and severe icing. The FAA defines severe turbulence as turbulence so bad that the airplane is briefly out of control. Severe icing builds so rapidly that deicing or anti-icing equipment cannot remove it. An airplane theoretically cannot continue to fly in severe icing or turbulence because it is sometimes out of control and building ice more quickly than it can be removed. Continued flight would likely be impossible.

Conditions that can accurately be described as severe seldom exist and, when they do, are usually not widespread. In contrast, sigmets warning of such conditions are common. FSS personnel cry wolf so often that it is easy for a pilot to ignore the warnings. This time, the wolf was real and it got the sheep.

On the other hand, the Phoenix FSS briefer sounds as if he knows his job. Weather conditions that may be manageable over the flatlands sometimes become impossible for piston airplanes over the mountains of the west. Before the introduction of turbine equipment, the major airlines spread a lot of sheet metal over the mountains while trying to maintain their winter schedules in piston airplanes and, every year, pilots of general aviation airplanes persist in doing the same.

This article is based on the National Transportation Safety Board's report of the accident and is intended to bring the issues raised to the attention of our readers. It is not intended to judge or to reach any definitive conclusions about the ability or capacity of any person, living or dead, or any aircraft accessory.

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Application to MAC.

As aviators with strategic and tactical missions, we in MAC must be alert for the temptation of second-guessing forecasts, weather estimates, and observations. It is easy to say "That wouldn't happen to me." However, mission demands, "get home-itis," or the enthusiasm of a crew eager to "hack the mission" could easily lead us down this primrose path. A quick review of MAC flight mishaps over the past several years reveals numerous accounts, some catastrophic, that bear witness to this gruesome truth. Advances in aircraft technology and the inherent "can do" attitude prevalent among MAC aircrews can easily lure us into doing something dumb. The problem is, when we're wrong it can be at the expense of many lives and an important national security asset.

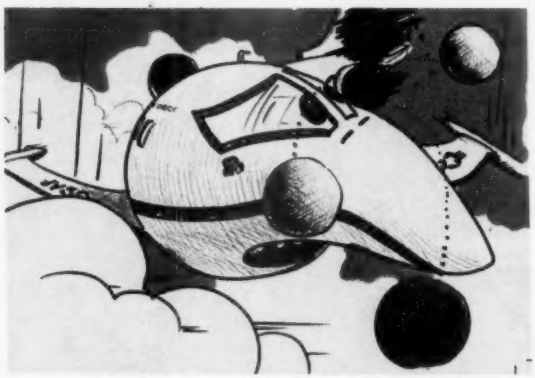
Excellence in Airmanship

Capt. Willam F. Conroy, III, 39 ARRW, displayed superior judgment and outstanding airmanship during a training flight on 10 Dec 85 when his single engine TH-1F helicopter experienced a malfunction in the droop cam linkage. Captain Conroy and his student briefed and planned the mission that included hovering autorotations. The flight began normally, with no indication of the impending emergency. The crew flew transition and simulated emergencies, including three sets of approximately five hovering autorotations, and completed other maneuvers between each set of hovering autorotations. Captain Conroy was preparing to demonstrate another hovering autorotation from a three-foot-hover. As he reduced the throttle to idle,the engine decelerated normally, but as Captain Conroy increased collective to cushion the landing, the engine began an uncommanded, rapid acceleration. Captain Conroy rolled the throttle to full open and decreased collective slightly to aid engine acceleration in an attempt to get the engine back in the automatic governing mode so he could recover the aircraft in a hover. However, this failed to stop the engine's acceleration. Captain Conroy then increased collective and retarded the throttle. The engine RPM decreased slightly, but the helicopter began rotating about its mast. Full opposite tail rotor pedal control wouldn't arrest the rotation. Captain Conroy accelerated the helicopter into forward flight, which reduced the rotation. He elected to recover the aircraft by shutting the engine down and performing an engine-out autorotation. He shut the engine down at approximately 1,000 feet AGL. He successfully flared the helicopter and landed uneventfully on the overrun of a closed runway. His superb airmanship and aircraft knowledge prevented injury to the crew and damage to or loss of a valuable helicopter. The exemplary execution of duties and the professionalism demonstrated by Captain Conroy is deserving of the MAC Safety Award for Excellence in Airmanship. Congratulations on a job well done!

Capt. William F. Conroy, III

Quick Stoppers

THE HEAT IS ON



Cruising along at night in their C-21A at FL 410, this stalwart crew was busily racking up the infamous "hours of boredom." In keeping with this well-worn aviation cliche, the "seconds of sheer panic" didn't wait long to appear. Suddenly the left engine chip light illuminated and the left engine's instrument readings began fluctuating. Just to add realism to the scenario, fate tossed in some heavy duty aircraft vibrations.

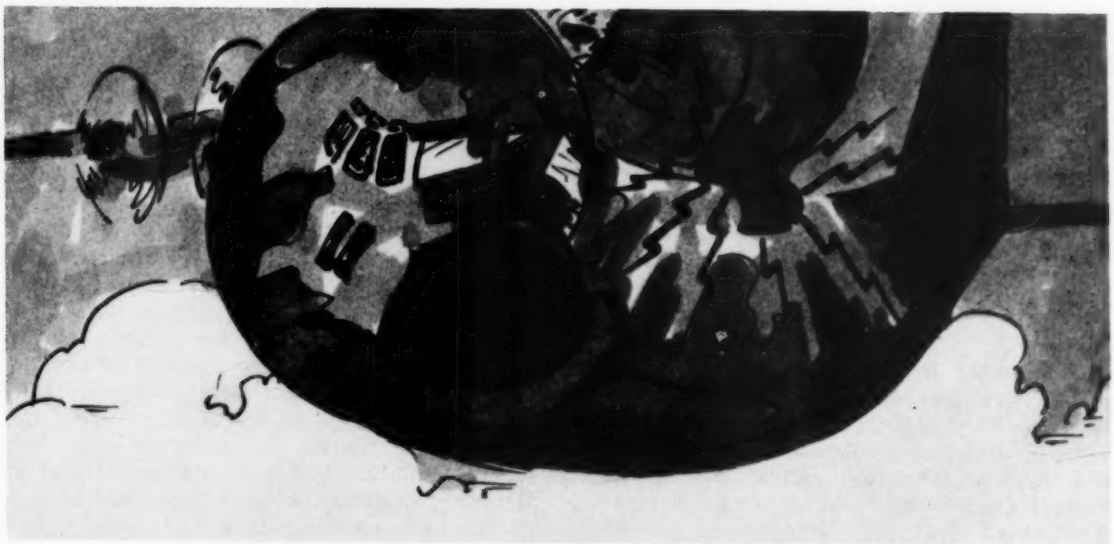
The crew reacted promptly by retarding the left engine throttle, but the vibration and other symptoms continued. Before the crew could react further, the vibrations stopped, as did the instrument reading fluctuations, and, unfortunately, the left engine as well. The pilot placed the left throttle in the cut-off position and completed the "engine failure in flight" checklist. Rendering due respect to the obvious genius who wrote "dual engine" into the aircraft design specifications, the pilot landed the aircraft uneventfully, then gratefully turned the beast over to the maintainers.

Engine teardown revealed the chain of events leading to the engine failure. The #5 bearing race had failed. This failure allowed the hot section to shift, proving once again the undesirable effects of a mobile hot section in a jet engine. This last event heat-damaged the turbine blades, inlet guide vanes, and interstage guide vanes. The exact toll in bucks wasn't released by the contractors but they stated the damage was "under $100,000." The bad news is, we don't know the first link in the chain—what caused the number-5 bearing race to fail. Another unsolved aviation "whatdunnit."

I'M SURE GLAD THE COWS DON'T FLY

This particular C-141 was flying a local proficiency mission including multiple approaches to a nearby civilian airfield. Following one particularly fine approach, the pilot began his usual recovery climb, when suddenly a feathered flier appeared from nowhere. The aircraft was at 200 KIAS and 2,500 feet, the bird was also at 2,500 feet, but before impact, he was at considerably less than 200 KIAS. The sudden acceleration had a decidedly acute effect on the hollow-boned aviator, and the aircraft's leading edge panel had to be replaced. The maintainers sent the panel to depot for rebuilding. The fowl creature wasn't so lucky; the depot for cattle egrets hasn't opened just yet.

JUST A TECHNIQUE ...

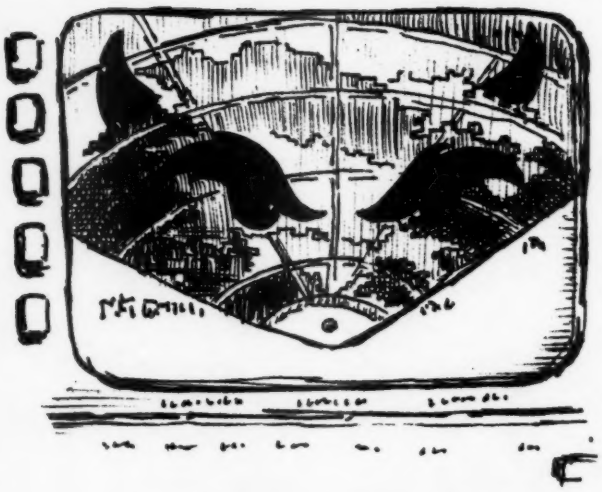


The C-130 crew was ready, alert, and excited about their imminent flight into simulated hostile territory. Fore and aft they prepared for the demanding scenario, including arrangements for additional outside vigilance. In this last endeavor to enhance the aircraft's visual security envelope, the loadmasters prepared the cargo compartment to allow them easier movement should the aircraft encounter uncoordinated lifties enroute. They positioned two straps across the cargo compartment forward of the paratroop doors and one aft; these were to serve as crossing handholds. Each planned to assume a position by the paratroop doors, enabling them to scan the skies for simulated bad guys they would undoubtedly encounter on this mission. This was a training, learning scenario, and there *is* a school solution to the problem of anticipated vertical instability during intentional departures from straight and level flight after dissimilar aircraft with *guns* are sighted. Unfortunately, neither of our airdrop activators selected the tried and true method for additional restraint (physical). One adopted the Macho, no-additional-restraint-necessary attitude, while the other fashioned his own variety restraint, a seat sling fashioned from the ubiquitous tiedown strap. Thus prepared, the mission profile unfolded.

True to the intelligence analysis, the Herk encountered a simulated aircraft soon after entering the "red area." The pilot immediately maneuvered the aircraft into a noncommercial airline flight attitude in response. Predictably, the cargo compartment followed the cockpit into this nonstandard attitude, just as the seat slung loadmaster leaned forward to visually acquire the simulated bad guy. The seat strap proved, once again, the laws of rotational forces and slipped up and away. The now-unrestrained loadmaster fell backward onto the intermediate rails. His nonsimulated injuries included three fractured vertebrae, which precluded his reentering the hostile arena (simulated or actual) for 133 days. Another successful simulated enemy strike, without a shot fired!

The Invincible Weather Radar

What it really does.



A recent flight highlighted (again) the need for caution while flying in IMC. This particular C-12 was on a short OSA-type flight to a nearby civilian airfield. Flying in IMC at approximately 3,500 feet MSL, the aircraft penetrated what appeared to be a rainshower. Post flight inspection, however, revealed hail damage to position lights, both wing leading edges, and around engine intakes. Fortunately that was the extent of the damage—this time.

This aircraft is radar-equipped, but that doesn't make it immune to meteorological phenomena. Having a weather radar aboard provides a crew forewarning of precipitation. It makes no value judgments (unless you consider color coding a judgment) for the crew; it merely presents information. To use this information responsibly, you've got to remember from whence it came. The radar measures reflectivity. It emits a pulse of energy which bounces off particles in the atmosphere large enough to reflect that particular wavelength. The wavelength selected for the radar is an optimum for the intended purpose of the radar. A higher or lower frequency wavelength would provide strikingly different returns for the same weather conditions. But you have no real control over that. What you can control, however, is the use of the information and the radar itself.

Once you perceive strong returns on the radar screen, flying into them probably sounds pretty dim-witted to you, as it should. But in your evasive maneuvering, what are you looking for—just a weak return on the screen? If so, you could be setting yourself up. One of the limitations affecting all radars is attenuation, and there are two main types of attenuation which can degrade radar performance. First is the effect of the precipitation you are "painting" on the screen. There comes a point beyond which the radar pulse can no longer penetrate the precipitation. This leaves a clear screen display on the far side of a thunderstorm. This can lead to an erroneous and dangerous interpretation that once past the immediate area's weather, you're in for smooth sailing. The second type of attenuation occurs at the aircraft. While you are flying in IMC conditions, a film of water builds over the radome. In reality the water is constantly running off, but new moisture replaces it as fast as it leaves, so in effect you have a blanket of water covering the nose of the aircraft. This won't harm radar operations at all. But as you fly through heavier precipitation, this layer gets thicker. While the radar pulses still make it through the film to the precipitation, the return pulse is much weaker. When the water layer builds to around one-half inch, the pulse can't make it back in to the receiver. The resultant clear screen is even more dangerous in this case because you are closer to the action.

There isn't a solution to flying in IMC conditions. We can't just stay home because it's cloudy or raining, but we *can* pay attention to the conditions we're exposing our radar to and then judge the presentation we're getting from the radar. We can also look at the heavy returns and compare them with other information, such as altitude winds, and use the information to determine which side of the thunderstorm to divert around. We can also learn to use the radar earlier, while we're still away from the main precipitation; the information we base our decisions on will be a lot more accurate that way.

After Deadlines

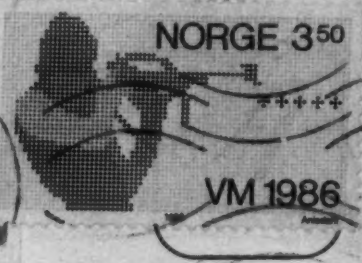
MAC HC-130 CRASHES NEAR KIRTLAND AFB—An HC-130, assigned to the 1550th Combat Crew Training Wing, crashed approximately 60 miles southwest of Albuquerque, New Mexico on 2 April, 1986. All 11 crewmembers perished in the mishap, which ended 339 days of Class A mishap-free flight for MAC. The aircraft had planned and was flying a low-level navigation training mission at the time of the mishap. The aircraft went down at approximately 1 PM in mountainous terrain.

C-130s RESTRICTED FROM FLIGHT—The Air Force has restricted 298 of its 735 C-130s pending inspection of the aircraft outer wing assemblies. This inspection is aimed at confirming the structural integrity of this portion of the wings. A wing modification program has been in effect since November 1983, and about 190 aircraft have already been modified. Officials estimate the inspection, fleetwide, will be complete in about 30 days. Aircraft will be returned to service as the inspections are completed.

PHYSIOLOGICAL TRAINING UPDATED—In early 1985 refresher training changed, incorporating weapon-systems-specific categories of training. These new categories include Tanker, Transport, Bomber (TTB); Trainer, Attack, Reconnaissance, Fighter (TARF); and Low and Slow (L & S). The Chief of Aerospace Physiology at HQ USAF has identified a new category for aircrew who change major weapon systems. Individuals transitioning to a new weapon system must receive refresher training in the new category not later than 60 days after the first flight in the new aircraft. For example, an ATC pilot selected to return to a TTB category aircraft will require the refresher, a fighter pilot selected as an ATC instructor would not, but a helicopter pilot selected for fixed wing transition would. This requirement ensures individuals receive current training, emphasizing human factors and performance areas specific to their weapon system.

☆ US GOVERNMENT PRINTING OFFICE: 1986 564-018/20014

F - 4455 - 0 Trondheim. Parti fra Nidelven med bryggene.
Norway The old ware-houses at Nidelven river.



PAR AVION
LUFTPOST

TRONDHEIM

STOTT

SAR 86

Dear Sammy,

Decided to visit Norway, m'lad. After my long flying career and extraordinary feats of airmanship, it's always nice to take time for a little diversion. Why I remember back in 82, or was it 83, when I met Col Fang....

HQ MAC/IGFE
THE MAC FLYER
SCOTT AFB, IL
62225
USA

Best wishes,
CR. Terror, Magnificent MAJOR.

ULTRA-TRYKK AS

ENERETT © KNUT Aune KUNSTFORLAG A.S.